PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Wells et al.

Patent No.: 7,055,626 B2

Issued: June 6, 2006

For: CORE BIT HAVING FEATURES FOR CONTROLLING FLOW SPLIT

Attorney Docket No.: 1684-4189US

VIA ELECTRONIC FILING
August 1, 2007

REQUEST FOR CERTIFICATE OF CORRECTION OF PATENT OFFICE MISTAKES (37 C.F.R. § 1.322)

Attn.: Certificate of Corrections Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

It is noted that several errors appear in this patent of a typographical nature. These errors are due to mistakes in printing on the part of the U.S. Patent and Trademark Office, and occurred through no fault of the Applicants. A certificate of correction in the form attached hereto is requested.

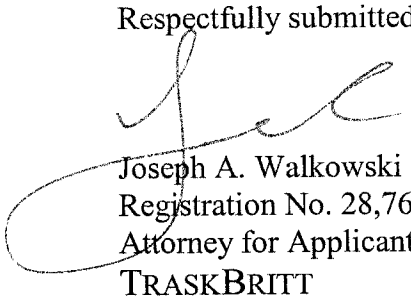
Please note that an Amendment Pursuant to 37 C.F.R. § 1.312(a) (copy enclosed) was filed concurrently with the issue fee on April 3, 2006, but apparently the amendments were not completely included before issuance of the patent. Attached is a copy of the previously filed Amendment Pursuant to 37 C.F.R. § 1.312(a) and the date-stamped postcard, acknowledging receipt by the PTO, to provide proof of such filing. We have included subject matter of this amendment on the attached PTO/SB/44 being suitable for printing.

Please send the Certificate to:

Name: Joseph A. Walkowski
Address: TraskBritt
P.O. Box 2550
Salt Lake City, Utah 84110

Attached hereto is Form PTO/SB/44 being suitable for printing.

Respectfully submitted,



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Date: August 1, 2007
JAW/csw

Enclosures: PTO/SB/44
Copy of Amendment Pursuant to 37 C.F.R. § 1.312(a)
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Document in ProLaw

PTO/SB/44 (06-07)
Approved for use through 06/30/2007. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO : 7,055,626 B2
APPLICATION NO. : 10/099,873
ISSUE DATE : June 6, 2006
INVENTOR(S) : Michael R. Wells, Luc Van Puymbroeck, and Holger Stibbe

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the specification:

COLUMN 1,	LINE 21,	change "formations—including" to --formations, including--
COLUMN 1,	LINES 22, 23	change "satura-tion—that" to --saturation, that--
COLUMN 1,	LINE 41,	change "is cut—by" to --is cut, by--
COLUMN 1,	LINE 43,	change "components—the" to --components, the--
COLUMN 5,	LINE 48,	change "cutters **30**—shown" to --cutters **30**, shown--
COLUMN 5,	LINE 49,	change "FIG. **3**—includes" to --FIG. **3**, includes--
COLUMN 5,	LINE 54,	change "line)" to --lines)--
COLUMN 6,	LINE 2,	change "inner substantially" to -- inner, substantially--
COLUMN 6,	LINE 3,	change "inner substantially" -- inner, substantially--
COLUMN 6,	LINE 51,	change "annulus **70**—the flow split—will" to --annulus **70**, the flow split, will--
COLUMN 7,	LINE 4,	change "dashed line)" to --dashed lines)--
COLUMN 9,	LINE 10,	change "core bit **100** as" to --core bit **100**, as--

MAILING ADDRESS OF SENDER (Please do not use customer number below):

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PTO/SB/44 (06-07)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO : 7,055,626 B2
APPLICATION NO. : 10/099,873
ISSUE DATE : June 6, 2006
INVENTOR(S) : Michael R. Wells, Luc Van Puymbroeck, and Holger Stibbe

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the specification:

COLUMN 10,	LINE 59,	change "not—for" to --not, for--
COLUMN 10,	LINE 60,	change "operation—depend" to --operation, depend--
COLUMN 10,	LINE 67,	change "structures—such as," to --structures, such as,--
COLUMN 10,	LINE 68,	change "features—are" to --features, are--

MAILING ADDRESS OF SENDER (Please do not use customer number below):

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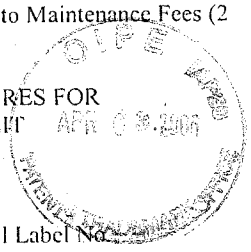
THE PATENT & TRADEMARK OFFICE MAILROOM DATE STAMPED HEREON IS AN ACKNOWLEDGEMENT THAT ON THIS DATE THE PATENT & TRADEMARK OFFICE RECEIVED:

Transmittal Letter (2 pages, in duplicate); Part B – Fee(s) Transmittal (1 page); Amendment Pursuant to 37 C.F.R. § 1.312(a) (18 pages); and Fee Addressee for Receipt of PTO Notices Relating to Maintenance Fees (2 pages)



Invention:	CORE BIT HAVING FEATURES FOR CONTROLLING FLOW SPLIT
Applicant(s):	Wells et al.
Filing Date:	March 15, 2002
Serial No.:	10/099,873
Date Sent:	April 3, 2006 via Express Mail Label No. EV669814023US
Docket No.:	1684-4189US
JAW/ps:slm	

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Wells et al.

Serial No.: 10/099,873

Filed: March 15, 2002

For: CORE BIT HAVING FEATURES FOR CONTROLLING FLOW SPLIT

Confirmation No.: 4455

Examiner: J. Gay

Group Art Unit: 3672

Attorney Docket No.: 1684-4189US (484-15631-US)

Notice of Allowance Mailed:

January 31, 2006

NOTICE OF EXPRESS MAILING

Express Mail Mailing Label Number: EV669814023US

Date of Deposit with USPS: April 3, 2006

Person making Deposit: Tim Palfreyman

AMENDMENT PURSUANT TO 37 C.F.R. § 1.312(a)

Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

Please amend the above-referenced application as follows:

Amendments to the Specification begin on page 2 of this paper.

A **Listing of the Claims** begins on page 8 of this paper.

Remarks begin on page 18 of this paper.

IN THE SPECIFICATION:

Please amend paragraph number **[0002]** as follows:

[0002] State of the Art: Formation coring is a well-known process in the oil and gas industry. In conventional coring operations, a core barrel assembly is used to cut a cylindrical core from the subterranean formation and to transport the core to the surface for analysis. Analysis of the core can reveal invaluable data concerning subsurface geological ~~formations including~~ formations, including parameters such as permeability, porosity, and fluid ~~saturation that~~ saturation, that are useful in the exploration for petroleum, gas, and minerals. Such data may also be useful for construction site evaluation and in quarrying operations.

Please amend paragraph number **[0003]** as follows:

[0003] A conventional core barrel assembly typically includes an outer barrel having, at one end, a core bit adapted to cut the cylindrical core and to receive the core in a central opening, or throat. The opposing end of the outer barrel is attached to the end of a drill string, which conventionally comprises a plurality of tubular sections that extends to the surface. Located within, and releasably attached to, the outer barrel is an inner barrel assembly having an inner tube configured for retaining the core. The inner barrel assembly further includes a core shoe disposed at one end of the inner tube adjacent the throat of the core bit. The core shoe is configured to receive the core as it enters the throat and to guide the core into the inner tube. Both the inner tube and core shoe are suspended within the outer barrel and rotate freely with respect to the core bit and outer barrel. Thus, as the core is ~~cut by~~ cut, by application of weight to the core bit through the outer barrel and drill string in conjunction with rotation of these ~~components the~~ components, the core will traverse the throat of the core bit to eventually reach the rotationally stationary core shoe, which accepts the core and guides it into the inner tube assembly where the core is retained until transported to the surface for examination.

Please amend paragraph number **[0020]** as follows:

[0020] FIG. 4 is a cross-sectional view of a core bit of an interior configuration according to the present invention and associated core shoe and inner tube as taken along line ~~III-III~~ III-III of FIG. 2;

Please amend paragraph number **[0021]** as follows:

[0021] FIG. 5 is an enlarged partial view of the exemplary core bit shown in ~~cross-section~~ cross-section in FIG. 3;

Please amend the first occurrence of paragraph number **[0023]** that was inserted by Amendment dated October 29, 2003, as follows:

~~[0023]~~ [0022.1] FIG. 6A is an enlarged partial view of a port of the present invention shown including a pyramidal port inlet;

Please amend the second occurrence of paragraph number **[0023]** as follows:

[0023] FIG. 7 is an enlarged partial view of the exemplary core bit shown in ~~cross-section~~ cross-section in FIG. 3;

Please amend the second occurrence of paragraph number **[0032]** as follows:

[0032] As can be seen in FIG. 2, the throat 14 opens into the bit body 12 at the face surface 20. Disposed on the face surface 20 is a plurality of blades 22. Attached to the blades 22 is a plurality of cutters 30 arranged in a selected pattern. The pattern of cutters ~~30 shown~~ 30, shown rotationally superimposed one upon another along the bit profile in FIG. ~~3 includes~~ 3, includes at least one outside gage cutter 32 that determines the diameter of the bore hole cut in the formation. The pattern of cutters 30 also includes at least one inside gage cutter 34 that determines the diameter of the core 200 (shown by dashed ~~line)~~ lines) being cut and entering the throat 14.

Please amend the second occurrence of paragraph number **[0034]** as follows:

[0034] The bit body 12 has an inner, substantially cylindrical cavity 16 extending longitudinally therethrough and bounded by an inside diameter 18. The throat 14 opens into the ~~inner~~ inner, substantially cylindrical cavity 16. Extending into the ~~inner~~ inner, substantially cylindrical cavity 16 of the bit body 12 is the inner tube 7. Disposed at the lower end of the inner tube 7 adjacent the throat 14 is a core shoe 50. The inner tube 7 and core shoe 50 are suspended so as to be able to freely rotate with respect to the core bit 10 and outer barrel 3. The core shoe 50 is configured and located to receive the core 200 as the core 200 traverses the throat 14 and to guide the core 200 into the inner tube 7. The core 200 is then retained in the inner tube 7 until the core 200 is transported to the surface for analysis.

Please amend the second occurrence of paragraph number **[0037]** as follows:

[0037] Drilling fluid circulating in the upper annular region 60 and collecting in the annular reservoir 80 will also flow into the narrow annulus 70. Drilling fluid entering the narrow annulus ~~70 the flow split will~~ 70, the flow split, will flow therethrough and exit the narrow annulus 70 through an annular gap 72 proximate the throat 14. The flow split can contact, and thereby invade and contaminate, the core 200 as the core 200 traverses the throat 14 and enters the core shoe 50.

Please amend the second occurrence of paragraph number **[0039]** as follows:

[0039] Shown in FIG. 4 is a core bit 100 having features for controlling flow split according to the present invention. The core bit 100 is disposed at the end of an outer barrel (not shown in FIG. 4) of a conventional core barrel assembly. The core bit 100 includes a bit body 112 having a face surface 120. A throat 114 configured to receive a core 200 (shown by dashed ~~line)~~ lines) being cut opens at the face surface 120 and extends into the bit body 112.

Please amend the second occurrence of paragraph number **[0047]** as follows:

[0047] Those of ordinary skill in the art will understand that the narrow annulus 170 extends about the entire circumference of the bit body 112 and, therefore, has a large ~~cross-sectional~~ cross-sectional area open to receive fluid flow from the annular reservoir 180. In contrast, the port inlets 144 are singular, spaced entrances disposed about the circumference of the bit body 112. Thus, increasing the cross-sectional area of the port inlets 144 that can receive fluid flow from the annular reservoir 180 is of critical importance. Numerical studies performed with the aid of a computer indicate that a conical shape 147 at the port inlets 144 can decrease flow split by approximately 44 percent. It will be appreciated by those of ordinary skill in the art that the shape 147 at the port inlets 144 may be of any suitable configuration that increases the ~~cross-sectional~~ cross-sectional area open to receive fluid flow from the annular reservoir 180, such as, by way of example only, a pyramidal shape, as shown in FIG. 6A.

Please amend the second occurrence of paragraph number **[0049]** as follows:

[0049] Referring to FIGS. 6 and 8, the annular reservoir 180 has a radial width 182. The radial width 182, and hence the volume, of the annular reservoir 180 has been significantly increased as compared to the radial width 82 and volume of the annular reservoir 80 in the conventional core bit 10 (see FIGS. 5 and 7). Numerical studies performed with the aid of a computer indicate that increasing the volume of the annular reservoir 180 by up to approximately 70 percent (as compared to the volume of the annular reservoir 80 of the conventional core bit 10) will provide an approximate 19 percent reduction in flow split. Increases in the volume of the annular reservoir 180 beyond about 70 percent may be detrimental to the structural integrity of the core bit ~~100~~ 100, as the corresponding increase in the radial width 182 may weaken the wall of the bit body 112. Those of ordinary skill in the art will understand that the upper limit on the increase in volume of the annular reservoir 180 and on the radial width 182 may vary depending on the design and geometry of the bit body 112 and on the material from which the bit body 112 is constructed.

Please amend the second occurrence of paragraph number **[0054]** as follows:

[0054] Numerical studies performed with the aid of a computer indicate that: a series of annular, rectangular cross-sectional reliefs 177 on the boundary profile 174 as shown in FIG. 9 provides an approximate 10 percent increase in pressure loss; an annular, triangular ~~cross-sectional~~ cross-sectional relief 178 on the boundary profile 174 as shown in FIG. 10 provides an approximate 32 percent increase in pressure loss; and an annular, circular cross-sectional relief 179 on the boundary profile 174 as shown in FIG. 11 provides an approximate 39 percent increase in pressure loss through the narrow annulus 170. Again, increased pressure loss through the narrow annulus 170 directly translates to a reduction in flow split. Any other suitable surface or topographical feature may be used to alter the boundary profile 174 according to the invention in order to introduce flow resistance in the narrow annulus 170. Those of ordinary skill in the art will appreciate that any one of the surface features 176, 177, 178, 179 imparted to the boundary profile 174 will individually increase resistance to fluid flow through the narrow annulus 170. In other words, a surface feature 176, 177, 178, 179 introduced to the boundary profile 174 according to the present invention does not require a second, mating surface feature to increase resistance to fluid flow in the narrow annulus 170, as was suggested in the prior art (see discussion of prior art set forth above).

Please amend the second occurrence of paragraph number **[0055]** as follows:

[0055] A core bit 100 according to the present invention may be manufactured using conventional core bit fabrication techniques. Machining, casting, or other suitable conventional metal forming techniques, or any combination thereof, may be used to form the novel features of the present invention, including: a port inlet 144 having a conical shape 147; a port inlet 144 having a relaxed angle of approach 148; an annular reservoir 180 having an increased radial width 182; and a narrow annulus 170 having a boundary profile 174 with one or more annularly extending squared edges 176, one or more annular, rectangular cross-sectional reliefs 177, one or more annular, triangular cross-sectional reliefs 178, or one or more annular, circular ~~cross-sectional~~ cross-sectional reliefs 179. All of the novel features of the core bit 100 according to

the present invention are integral to the core bit 100 itself, and no modifications to other components of the conventional core barrel assembly, including the core shoe, are required. It will be appreciated by those of ordinary skill in the art that fabrication of the novel features of the core bit 100 does ~~not for~~ not, for proper functioning of the core bit 100 providing a reduced flow split during a coring ~~operation depend~~ operation, depend upon the maintenance of a close mating (or contacting) fit between two surfaces rotating relative to one another. Further, those of ordinary skill in the art will appreciate that the novel features of the core bit 100 will not significantly affect the mechanical strength of the core bit 100, as no weak ~~structures such~~ structures, such as, for example, thin cross-sectioned geometric ~~features are~~ features, are imparted to the core bit 100.

IN THE CLAIMS:

Claims 3, 4, 6, 7, 9, 11, 19-21, 23, and 25-27 were previously cancelled. None of the claims have been amended herein. All of the pending claims are presented below. This listing of claims will replace all prior versions and listings of claims in the application. Please enter these claims as previously amended.

Listing of Claims:

1. (Previously presented) A core bit, comprising:

a bit body having a face surface with a throat opening thereinto, the throat extending to a longitudinal cavity defined by at least one longitudinally oriented wall;

at least one cutter disposed on the face surface; and

at least one bore extending through the bit body between at least one port inlet and at least one port outlet;

wherein the at least one port outlet is formed in the face surface of the bit body;

wherein the at least one port inlet is formed within the bit body and comprises a generally pyramidal shape; and

wherein the at least one port inlet opens into the longitudinal cavity through at least a portion of the at least one longitudinally oriented wall.

2. (Previously presented) A core bit, comprising:

a bit body having a face surface with a throat opening thereinto, the throat extending to a longitudinal cavity defined by at least one longitudinally oriented wall;

at least one cutter disposed on the face surface; and

at least one bore extending through the bit body between at least one port inlet and at least one port outlet;

wherein the at least one port outlet is formed in the face surface of the bit body;

wherein the at least one port inlet is formed within the bit body and comprises a generally pyramidal shape; and

wherein the at least one port inlet includes a first end having a first cross-sectional area joined to the at least one bore and extending to a second end having a second cross-sectional area larger than the first cross-sectional area, the second end opening into the longitudinal cavity through at least a portion of the at least one longitudinally oriented wall.

3. (Cancelled)

4. (Cancelled)

5. (Previously presented) A core barrel assembly for cutting core samples in subterranean formations, comprising:

an outer barrel having one end attached to a drill string;

an inner barrel assembly rotatably disposed inside the outer barrel, the inner barrel assembly including an inner tube and a core shoe attached to one end of the inner tube;

a core bit attached to an opposing end of the outer barrel proximate the core shoe, the core bit including:

a bit body having a face surface with a throat opening thereinto, the throat extending to a longitudinal cavity defined by at least one longitudinally extending wall;

at least one cutter disposed on the face surface; and

at least one bore extending through the bit body between at least one port inlet and at least one port outlet;

wherein the at least one port outlet is formed in the face surface of the bit body;

wherein the at least one port inlet is formed generally within the bit body and comprises a generally pyramidal shape; and

wherein the at least one port inlet includes a first end having a first cross-sectional area joined to the at least one bore and extending to a second end having a second cross-sectional area larger than the first cross-sectional area, the second end opening into the longitudinal cavity through at least a portion of the at least one longitudinally oriented wall.

6. (Cancelled)

7. (Cancelled)

8. (Previously presented) A core bit for attachment to a core barrel assembly, the core barrel assembly including an outer barrel, an inner tube disposed within the outer barrel, and a core shoe disposed at one end of the inner tube, comprising:

a bit body including a face surface and further including an inner, substantially cylindrical, longitudinally extending cavity bounded by an inside diameter of the bit body, and configured to receive at least the core shoe therein;

wherein a flow path is defined by an annular region bounded by the inside diameter of the bit body and an outside diameter of at least the core shoe;

at least one cutter disposed on the face surface; and

at least one bore extending through the bit body between at least one port inlet and at least one port outlet;

wherein the at least one port inlet forms an angle of approach relative to the flow path defined by the annular region proximate the at least one port inlet of about 30 degrees;

wherein the at least one port outlet is formed in the face surface of the bit body.

9. (Cancelled)

10. (Previously presented) A core barrel assembly for cutting core samples in subterranean formations, comprising:

an outer barrel having one end attached to a drill string;

an inner barrel assembly disposed inside the outer barrel, the inner barrel assembly including an inner tube and a core shoe attached to one end of the inner tube;

a core bit attached to an opposing end of the outer barrel proximate the core shoe, the core bit including:

a bit body including a face surface and further including an inner, substantially cylindrical, longitudinally extending cavity bounded by an inside diameter of the bit body, at least the core shoe extending into the cavity;

wherein a flow path is defined by an annular region bounded by the inside diameter of the bit body and an outside diameter of at least the core shoe;

at least one cutter disposed on the face surface;

at least one bore extending through the bit body between at least one port inlet and at least one port outlet;

wherein the at least one port inlet forms an angle of approach relative to the flow path defined by the annular region proximate the at least one port inlet of about 30 degrees;

wherein the at least one port outlet is formed in the face surface of the bit body.

11. (Cancelled)

12. (Previously presented) A core bit for attachment to a core barrel assembly including a core shoe of a predetermined exterior configuration, the core bit comprising:

a bit body including a face surface and further including an inner, substantially cylindrical cavity longitudinally extending therethrough;

at least one cutter disposed on the face surface; and

at least one bore extending through the bit body between at least one port inlet and at least one port outlet;

wherein the at least one port outlet is formed in the face surface of the bit body;

wherein the at least one port inlet opens into the cavity at a region thereof defining an annular reservoir, the annular reservoir configured to induce fluid recirculation zones in fluid passing therethrough.

13. (Previously presented) A core bit for attachment to a core barrel assembly, the core barrel assembly including an outer barrel, an inner tube disposed within the outer barrel, and a core shoe of a predetermined exterior configuration disposed at one end of the inner tube, comprising:

a bit body including a face surface and further including an inner, substantially cylindrical cavity longitudinally extending therethrough, at least the core shoe extending into the cavity;

at least one cutter disposed on the face surface; and

at least one surface feature extending from a wall of the cavity configured to individually impart resistance to fluid flow in a narrow annulus defined by the wall of the cavity and an outside surface of the core shoe.

14. (Previously presented) The core bit of claim 13, wherein the at least one surface feature is selected from the group consisting of:

at least one annularly extending squared edge;

at least one annular, generally rectangular cross-sectional relief;

at least one annular, generally triangular cross-sectional relief; and

at least one annular, generally circular cross-sectional relief.

15. (Previously presented) A core barrel assembly for cutting core samples in subterranean formations, comprising:

an outer barrel having one end attached to a drill string;

an inner barrel assembly disposed inside the outer barrel, the inner barrel assembly including an inner tube and a core shoe of a predetermined exterior configuration attached to one end of the inner tube;

a core bit attached to an opposing end of the outer barrel proximate the core shoe, the core bit including:

a bit body including a face surface and further including an inner, substantially cylindrical cavity longitudinally extending therethrough, at least the core shoe extending into the cavity;

at least one cutter disposed on the face surface; and

at least one surface feature extending from a wall of the cavity configured to individually impart resistance to fluid flow in a narrow annulus defined by the wall of the cavity and an outside surface of the core shoe.

16. (Previously presented) The core barrel assembly of claim 15, wherein the at least one surface feature is selected from the group consisting of:

at least one annularly extending squared edge;

at least one annular, generally rectangular cross-sectional relief;

at least one annular, generally triangular cross-sectional relief; and

at least one annular, generally circular cross-sectional relief.

17. (Previously presented) A core bit for attachment to a core barrel assembly, the core barrel assembly including an outer barrel, an inner tube disposed within the outer barrel, and a core shoe of a predetermined exterior configuration disposed at one end of the inner tube, comprising:

a bit body including a face surface and further including an inner, substantially cylindrical, longitudinally extending cavity bounded by a wall of the cavity, at least the core shoe extending into the cavity;

wherein a flow path is defined by an annular region bounded by the wall of the cavity and an outside surface of at least the core shoe;

at least one cutter disposed on the face surface;

at least one port outlet disposed on the face surface;

at least one bore extending through the bit body between at least one port inlet and at least one port outlet; and

wherein the at least one port inlet opens into the annular region and includes a first end having a first cross-sectional area joined to the at least one bore and extends to a second end having a second cross-sectional area larger than the first cross-sectional area, the at least one port inlet forming an angle of approach relative to the flow path defined by the annular region proximate the at least one port inlet of about 30 degrees.

18. (Previously presented) The core bit of claim 17, further comprising at least one topographical feature disposed on the wall of the cavity configured to individually impart resistance to fluid flow in a narrow annulus defined by a portion of the wall of the cavity below the annular region and an outside surface of the core shoe.

19.-20. (Cancelled)

22. (Previously presented) A port structure for delivering drilling fluid to a face surface of a core bit attached to a core barrel assembly, the core barrel assembly including an outer barrel, an inner tube disposed within the outer barrel, and a core shoe disposed at one end of the inner tube adjacent the core bit, at least the core shoe extending into an inner, substantially cylindrical cavity longitudinally extending into the core bit, wherein a flow path is defined by an annular region bounded by a wall of the cavity and an outside surface of the core shoe, the port structure comprising:

a bore extending through the core bit between at least one port inlet and at least one port outlet; and

wherein the at least one a port inlet forms an angle of approach relative to the flow path defined by the annular region proximate the at least one port inlet of about 30 degrees.

23. (Cancelled)

24. (Previously presented) A method of reducing a quantity of fluid flowing from an annular region bounded by a wall of a cavity through a core bit and an outside surface of a core shoe disposed therein, and into a narrow annulus therebelow defined by the wall of the cavity and the outside surface of the core shoe, the narrow annulus in fluid communication with the annular region, the method comprising:

providing a plurality of ports, each port including a bore and extending through the core bit between an inlet and an outlet;

reducing a quantity of fluid flow through the narrow annulus, the reducing comprising:

enlarging a cross-sectional area of the port inlet of each port of the plurality of ports relative to a cross-sectional area of the bore of each port of the plurality of ports, each port inlet of the each port proximate to the annular region; and

receiving fluid from the annular region into the enlarged cross-sectional area of each port inlet.

25.-27. (Cancelled)

28. (Previously presented) The method of claim 24, further comprising recirculating fluid within the annular region.

29. (Previously presented) The method of claim 24, further comprising imparting circumferential flow to fluid within the annular region.

REMARKS

This amendment corrects errors in the text. Entry is respectfully solicited.

This amendment is submitted prior to or concurrently with the payment of the issue fee and, therefore, no petition or fee is required. No new matter has been added.

Respectfully submitted,

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Date: April 3, 2006
JAW/csw

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